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10/710,946	08/13/2004	Roman Chistyakov	ZON-015	4945

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EXAMINER	
SALZMAN, KOURTNEY R	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/710,946	CHISTYAKOV, ROMAN	
	Examiner	Art Unit	
	KOURTNEY R. SALZMAN	4128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 November 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-45* is/are pending in the application.

4a) Of the above claim(s) *23-44* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-22 and 45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *August 20, 2004, November 22, 2004, December 12, 2005, April 9, 2006 and May 22, 2007,* .
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of group I (claims 1-22 and 45) in the reply filed on November 21, 2007 is acknowledged.

2. Claims 23-44 are withdrawn.

Summary

3. This is the first Office Action on the merits of application 10/710,946 entitled Plasma Source with Segmented Magnetron Cathode, filed August 13, 2004. This application claims priority from provisional application 60/481,671, filed November 19, 2003.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 2, 5, 9, 10, 12-16, 18, 22 and 45 rejected under 35 U.S.C. 102(b) as being anticipated by HAAG et al (US 6,093,293).

HAAG et al teaches a magnetron sputtering source comprising a process chamber, as shown in figures 1-3, as reference number 10, connected with valves for to feed gases into the chamber, as seen in figure 7 and stated in column 7, lines 1-5. Regarding the second limitation of claim 1, the process chamber is shown, in figure 4, to contain the anode, reference number 39.

Regarding the segmented magnetron cathode of the third limitation of claim 1, figure 1 shows target arrangements (separate individual cathodes), reference number 3, "connected to a generator 9, each of which generators can be controlled independently". (c. 7, l.12-15) Since each are connected to separate generators, they are shown to be electrically separated, or isolated from each other. The cathode or target arrangement segments are shown in figure 1, as reference number 3, to be adjacent to the anode segments 7, as they are shown next to each other. There are also permanent magnet segments "provided on each of the target arrangements", as stated in claim 9, lines 49-52, allowing for the cathode to function as a magnetron cathode. Regarding the switch and power supply limitations, these pieces have been combined into the generators. The electrical the power supply is the generator. The generators also feature time modulation feature, which operates as the switch, specifically modulating the traveling wave. (c. 7, lines 35-40) The switch electrical input takes the form of the power generated in the generator. The switch is then has multiple outputs to the cathode, or target arrangements, as shown in figure 1. (c.7, lines 45-48) The power supply outputs, are distributed to the switch then the cathodes using the time modulation, which allow the output to be "pulsed DC signals, or DC generators with intermediate generator output". (c.7, l.15-21) The time modulators are capable of generating a plasma train of voltages, through the time modulation controller.

Regarding claim 2, in conjunction with the rejection of claim 1, figure 1 shows multiple anode segments, with the reference number 7, all adjacent to the neighboring cathode or target arrangement segments, 3.

Regarding claim 5, in conjunction with the previous rejection of claim 1, the cathode segments are called target segments within HAAG et al, clearly anticipating the claimed sputtering target material.

Regarding claim 9, in conjunction with the previous rejection of claim 1, HAAG et al shows, in figure 4, the location of 3 cathode segments, yet doesn't require more of a cathode arrangement, or symmetric arrangement as shown. Therefore, what is shown is that the magnetron cathode can function as the cathode segments which are placed in a unique vertical plane, or an asymmetrical plane perpendicular to the substrate, as disclosed in the instant application.

Regarding claim 10, in conjunction with the previous rejection of claim 1, while HAAG et al does not explicitly state the size of the cathode segments should be uniform in size, by not showing any complete magnetron with all the segments, as in figure 4, it implicitly teaches, the sizing is irrelevant. Each cathode is powered separately, creating its own plasma, only the magnets which control the plasma should be approximately the size of the cathode segments. Since this

correlation is industry standard, the magnet arrangement shown in figure 7 indicates that the cathode segments could be of approximately sized to correspond with the three different magnet sizes of Z'1, Z'2 and Z'3.

Regarding claims 12-15, in conjunction with the previous rejection of claim 1, the apparatus necessary for the functionality of these claims is present in HAAG et al. The generator taught therein is able to deploy voltage pulses based on any modulation to function in any programmed pattern, complete with amplitude modulation (c.7, l.48-51) as the "invention allows very high flexibility for electrically operating the individual target arrangements 3". (c. 7, l. 66 - c.8, l. 5)

Regarding claim 16, in conjunction with the previous rejection of claim 1, the description of figure 7 states “at least two permanent magnet drums 43 are preferably provided on each of the target arrangements 3”. (c. 9, l. 48-51) The two are shown proximate to each other in figure 7 itself.

Regarding claim 18, in conjunction with the previous rejection of claim 1, in column 9, lines 1-4, HAAG et al states there are gas attachments for the addition of a "working gas such as argon and/or with a reactive gas".

Regarding claim 22, in conjunction with the previous rejection of claim 1, the time modulating function, as discussed in the rejection of claim 1, functions to control the pulse sequencing as a controller would function.

Regarding claim 45, teaches a magnetron sputtering source comprising a process chamber, as shown in figures 1-3, as reference number 10, connected with valves for to feed gases into the chamber, as seen in figure 7 and stated in column 7, lines 1-5. The generators provide the means for generating pulses, as discussed in c. 7, l. 47-49. The generators also apply the means for applying both the first, second and subsequent pulses, in conjunction with the distribution wiring shown in figures 1-3, applying the pulses to each of the pulses to the target arrangements or cathodes of the magnetron.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of ROGERS, JR. et al (US 5,135,554).

HAAG et al teaches adjacent cathode and anode segments. HAAG et al also teaches the electrical manipulation of target arrangements, which function in the sputtering apparatus as cathodes.

HAAG et al fails to disclose a concentric orientation of cathode and anode or the use of more than one target material on each target or cathode segment.

Regarding claim 3, in conjunction with the previous rejections of claims 1 and 2, ROGERS, JR et al teaches an apparatus and method for sputtering, wherein in figure 3, the cathodes or targets of reference numbers 48. 50 and 52, are located central to the fiber, or workpiece, which generally has an opposing charge to the target, or anodic potential. Both pieces share a common central location, as the center of the fiber.

At the time of invention, it would be obvious for the anodes and cathodes of HAAG et al to have the common central orientation taught by ROGERS, JR. et al, because this orientation allows for total coating of the workpiece throughout the duration of the sputtering operation. This creating of a thin film around the entire workpiece or the deposition of a single film on a single surface is a matter of engineering choice, and desired characteristics of the sputtered product. Therefore, the choice of centralized orientation of the anode and cathode would be obvious to one of ordinary skill in the art.

Regarding claim 6, in conjunction with the previous rejections of claim 1, ROGERS, JR. et al teaches an apparatus for use of continuous sputter coating, where the sputtering units 48, 50 and 52 “may include the same target material, or alternatively, the sputtering units may include a different target material". Sputtering units 48, 50 and 52 function as separate cathode segments as in the instant application.

At the time of invention, it would have been obvious to one of ordinary skill in the art to apply different target materials as in ROGERS, JR et al to the target arrangements of HAAG et al because, as stated in ROGERS, JR et al, the diversification of materials “provides for the sequential application of layers of different materials... in a single process". (c. 4, l. 54-55) This allows for easier manufacture, a consistent and long standing goal in the industry.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of BERGMAN (US 4,132,961).

HAAG et al teaches a sputtering source comprising multiple anode segments, as identified in the rejection of claim 1, and gas feed shown independent of the anode, which feeds to the sputtering chamber, as identified in the rejection of claim 18 above.

HAAG et al fails to teach these two pieces integrally constructed to form a single gas injector.

Regarding claim 4, in conjunction with the previous rejection of claim 1, BERGMAN teaches a flowing gas laser which utilizes a wire anode gas injector to feed gas into the discharge chamber, as stated in the abstract.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the gas valve and anode of HAAG et al into a single integral anode gas injector as in BERGMAN because it is obvious to make what is separate an integral piece (MPEP 2144.04). This assimilation of pieces allows for the gas to be ignited creating plasma just above the surface of the anode, still allowing for the same operating conditions as that created in the reference HAAG et al.

9. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of SIECK et al (US 5,616,225).

HAAG et al teaches the cathode segments situated adjacent to each other and also the anode segments.

HAAG et al fails to teach the situation of the cathode pieces within a hollow cathode.

Regarding claim 7, in conjunction with the previous rejection of claim 1, SIECK et al teaches the use of multiple anodes in a magnetron for improving the uniformity of the plasma which organizes the cathodes within a hollow magnetron cathode tube, as is shown in figure 4 and discussed in the abstract.

At the time of invention, it would have been obvious to one of ordinary skill art to form the cathode segments of HAAG et al in the hollow cathode arrangement of SIECK et al because the use of this layout allows for "the uniformity of the rate of deposition across the substrate [to be] improved", as stated in the abstract of SIECK et al. Therefore, through improved characteristics, the combination of the anode and cathode segments of HAAG in the organization of SIECK et al is obvious.

10. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293).

HAAG et al teaches all the limitations of claim 1.

HAAG et at fails to explicitly teach the cathode segments being located in a unique horizontal plane.

Regarding claim 8, in conjunction with the previous rejection of claim 1, HAAG et al does teach, in figure 4, the location of 3 cathode segments, yet doesn't require more of a cathode arrangement, or symmetric arrangement as shown. Therefore, what is shown is that the magnetron cathode can function as the cathode segments are placed in a unique vertical plane, or an asymmetrical plane perpendicular to the substrate, as disclosed in the instant application.

At the time of invention, it would have been obvious to place the cathode segments in a unique horizontal orientation for deposition, since HAAG et al shows that the positioning of the cathode segments in a unique vertical orientation can yield successful, predictable deposition. With the independent control of each cathode segment, ignition to create plasmas of different depths would allow the plasma to continue aiding in the deposition process, not only making the outcome plausible, but predictably successful.

11. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of HOFFMAN, JR et al (PG PUB US 2002/0157964).

HAAG et al teaches all the limitations of claim 1.

HAAG et al fails to teach the use of any transistors, including insulated gate bipolar transistor (IGBT).

HOFFMAN, JR et al teaches a method and apparatus for electrolytic cleaning comprising the use of an insulated gate bipolar transistor (IGBP) to "convert the DC output into AC through very fast on/off switching", as stated in paragraph 44.

At the time of invention, one of ordinary skill in the art would have been motivated to use a IGBP as disclosed in HOFFMAN, JR et al for the control of electronic pulses, in the sputtering device disclosed in HAAG et al because the use of an IGBP is well known in pulsed power devices, as it is highly efficient in pulsed, quickly switching electronic flows.

12. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of GLOCKER et al(PG PUB US 2001/0050225).

HAAG et al teaches all the limitations of claims 1 and 16, including the use of a magnetic field to control the plasma allocation.

HAAG et al fails to teach the generation of an unbalanced magnetic field.

GLOCKER et al teaches an apparatus for ion bombardment of a substrate comprising unbalance magnetic fields. In paragraph 31, GLOCKER et al teaches "a first embodiment 50 of an unbalanced cylindrical magnetron", as shown in figure 4.

At the time of the invention, it would be obvious to one of ordinary skill in the art to use the magnetron apparatus as disclosed in HAAG et al to generate the unbalanced field as disclosed in GLOCKER et al because as GLOCKER et al discloses in paragraph 9, the layout of the plasma profile allows for "a consistent and predictable coating on substrates". It is obvious that consistency allows for successful and predictable manufacture, a goal of the any manufacturing process.

13. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of SOLTAN (US 3,609,658).

HAAG et al teaches all the limitations of claim 1, including the addition of gases (as stated in the rejection of claim 18) into the chamber through valves.

HAAG et al fails to teach the injection of excited and metastable atoms into the sputtering chamber.

Regarding claims 19 and 20, SOLTAN teaches a plasma display device which inserts a "flux of electrons, ions, and metastable atoms to flow through the display matrix 9". (c. 3, l. 65-68) The ions are analogous to the excited atoms of claim 19.

At the time of invention, it would have been obvious to one of ordinary skill in the art to combine the addition of ions and metastable atoms, as disclosed in SOLTAN, into the chamber and dispersion apparatus of HAAG et al because SOLTAN suggests in c. 3, l. 72 - c. 4, l.3, that the addition of these atoms lowers the firing potential (or ignition energy) causing the "cells or sites to be substantially uniform". This uniformity in the plasma display device would be valuable to a segmented cathode, as each cathode functions as a cell set, which would allow for uniform ignition of plasma over all the cathode cells.

14. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over HAAG et al (US 6,093,293) in view of RHODES (US 5,410,425).

HAAG et al teaches all the limitations of claim 1.

HAAG et al fails to teach the use of a pre-ionizing electrode in the chamber.

RHODES teaches a magnetron cathode comprising the use of a pre-ionization voltage pulse. In column 3, lines 46-50, RHODES states, "in operation, a pre-ionization voltage pulse from source 32 is applied across cathode 22 and anode 24… conducting plasma". This pre-ionization voltage functions as a pre-ionization electrode would in the plasma.

At the time of invention, one of ordinary skill in the art would be motivated to use the pre-ionization voltage of RHODES in the magnetron cathode of HAAG et al because RHODES et al teaches the pre-ionization operation functions to "guarantee that the current pulses on each side of the cell are well synchronized", which would be key when trying to consistently ionize over several cells, or cathode segments as in the instant application.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KOURTNEY R. SALZMAN whose telephone number is (571)270-5117. The examiner can normally be reached on Monday to Friday 7AM to 4PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara Gilliam can be reached on (571) 272-1330. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Barbara L. Gilliam/
Supervisory Patent Examiner, Art Unit 4128

krs